LOGANEnergy

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LOGANEnergy Corp.

US Army Schofield Barracks, HI PEM Demonstration Project

Proton Exchange Membrane (PEM) Fuel Cell Demonstration
Of Domestically Produced PEM Fuel Cells in Military Facilities

US Army Corps of Engineers
Engineer Research and Development Center
Construction Engineering Research Laboratory
Broad Agency Announcement CERL-BAA-FY03

US Army Schofield Barracks Fire Station

27 September 2004

Executive Summary

Under terms of its FY'03 DOD PEM Demonstration Contract with ERDC/CERL, LOGANEnergy will install and operate a Plug Power GenSys 5kWe Combined Heat and Power fuel cell power plant at US Army Schofield Barracks, HI fire station. This site was selected during a base tour with Schofield Barracks representatives during a visit on September 8, 2004.

Schofield representatives proved to be very enthusiastic during the visit and have been supportive in moving the installation plans along at a rapid pace.

The unit will be electrically configured to provide grid parallel/grid independent service and also thermally integrated with the fire station's hot water heater. Local electrical and mechanical contractors will be hired to provided services as needed to support the installation tasks. It is anticipated that the project will add an additional $1,042 energy costs to the base during the period of performance.

The base POC for this project is Keith Yamanaka whose coordinates are:

Email: YamanakK@schofield.army.mil

Telephone: (808) 656-1410 ext.1120

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Proposal – Proton Exchange Membrane (PEM) Fuel Cell Demonstration of Domestically Produced Residential PEM Fuel Cells in Military Facilities

1.0 Descriptive Title

LOGANEnergy Corp. Small Scale PEM 2003 Demonstration Project at US Army Schofield Barracks, Hawaii.

2.0 Name, Address and Related Company Information

LOGANEnergy Corporation

1080 Holcomb Bridge Road
BLDG 100- 175
Roswell, GA 30076
(770) 650- 6388

DUNS 01-562-6211
CAGE Code 09QC3
TIN 58-2292769

LOGANEnergy Corporation is a private Fuel Cell Energy Services company founded in 1994. LOGAN specializes in planning, developing, and maintaining fuel cell projects. In addition, the company works closely with manufacturers to implement their product commercialization strategies. Over the past decade, LOGAN has analyzed hundreds of fuel cell applications. The company has acquired technical skills and expertise by designing, installing and operating over 30 commercial and small-scale fuel cell projects totaling over 7 megawatts of power. These services have been provided to the Department of Defense, fuel cell manufacturers, utilities, and other commercial customers. Presently, LOGAN supports 30 PAFC and PEM fuel cell projects at 21 locations in 12 states, and has agreements to install 22 new projects in the US and the UK over the next 18 months.

3.0 Production Capability of the Manufacturer

Plug Power manufactures a line of PEM fuel cell products at its production facility in Latham, NY. The facility produces three lines of PEM products including the 5kW GenSys5C natural gas unit, the GenSys5P LP Gas unit, and the GenCor 5kW standby power system. The current facility has the capability of manufacturing 10,000 units annually. Plug will support this project by providing remote monitoring, telephonic field support, overnight parts supply, and customer support. These services are intended to enhance the reliability and performance of the unit and achieve the highest possible customer satisfaction. Scott Wilshire is the Plug Power point of contact for this project. His phone number is 518.782.7700 ex1338, and his email address is scott_wilshire@plugpower.com.

4.0 Principal Investigator(s)

Name	Samuel Logan, Jr.	Keith Spitznagel
Title	President	Vice President Market Engagement
Company	Logan Energy Corp.	Logan Energy Corp.
Phone	770.650.6388 x 101	860.210.8050
Fax	770.650.7317	770.650.7317
Email	samlogan@loganenergy.com	kspitznagel@loganenergy.com

5.0 Authorized Negotiator(s)

Name	Samuel Logan, Jr.	Keith Spitznagel
Title	President	Vice President Market Engagement
Company	Logan Energy Corp.	Logan Energy Corp.
Phone	770.650.6388 x 101	860.210.8050
Fax	770.650.7317	770.650.7317
Email	samlogan@loganenergy.com	kspitznagel@loganenergy.com

6.0 Past Relevant Performance Information

a) Contract: PC25 Fuel Cell Service and Maintenance Contract #X1237022

Merck & Company
Ms. Stephanie Chapman
Merck & Company
Bldg 53 Northside
Linden Ave. Gate
Linden, NJ 07036
(732) 594-1686

Contract: Four-year PC25 PM Services Maintenance Agreement.
In November 2002 Merck & Company issued a four-year contract to LOGAN to provide fuel cell service, maintenance and operational support for one PC25C fuel cell installed at their Rahway, NJ plant. During the contract period the power plant has operated at 94% availability.

b) Contract: Plug Power Service and Maintenance Agreement to support one 5kWe GenSys 5C and one 5kWe GenSys 5P PEM power plant at NAS Patuxant River, MD. .

Plug Power
Mr. Scott Wilshire.
968 Albany Shaker Rd.
Latham, NY 12110
(518) 782-7700 ex 1338

LOGAN performed the start-up of both units after Southern Maryland Electric Cooperative completed most of the installation work and continues to provide service and maintenance during the period of performance.

c) Contract: A Partners LLC Commercial Fuel Cell Project Design, Installation and 5-year service and maintenance agreement.
Contract # A Partners LLC, 12/31/01

Mr. Ron Allison
A Partner LLC
1171 Fulton Mall
Fresno, CA 93721
(559) 233-3262

On April 20, 2004 LOGAN completed the installation of a 600kWe PC25C CHP fuel cell installation in Fresno, CA. The fuel cells also provide low-grade waste heat at 140 degrees F that furnishes thermal energy to 98 water source heat pumps located throughout the 12-story building during the winter months.

7.0 Host Facility Information

Picture of US Army Schofield Barracks under attack Dec 7, 1941.

In 1872, Major General John M. Schofield, Commanding General of the US Army's Pacific Division, visited the Hawaiian Islands to determine the defense capabilities of its ports. He concluded that a harbor could be formed at the mouth of the Pearl River and that it could be easily defended. After the 1898 annexation of Hawaii by the United States, military forces started moving to the islands. In April 1909, the War Department renamed the post to Schofield Barracks from the name most often used in the area, "Castner Village".

The Secretary of War approved plans for construction and troop build-up at Schofield Barracks in 1911. The plans called for five infantry regiments, and one each of cavalry and field artillery. Those plans were later altered but permanent quarters were needed for the four regiments already on post. The first permanent structures on post, which still exist today, were the quadrangle barracks.

When all of Schofield's troops were called to war in 1917 the Hawaiian National Guard moved in and after the Armistice was signed in November 1918 they began beautifying the post. The National Guard planted many of the large trees seen on Schofield Barracks, including the Norfolk Pines. Construction that was postponed during the war was resumed in the early 1920's. An extension of the Oahu Railway and Land Company railroad was built to pass in front of the quads.

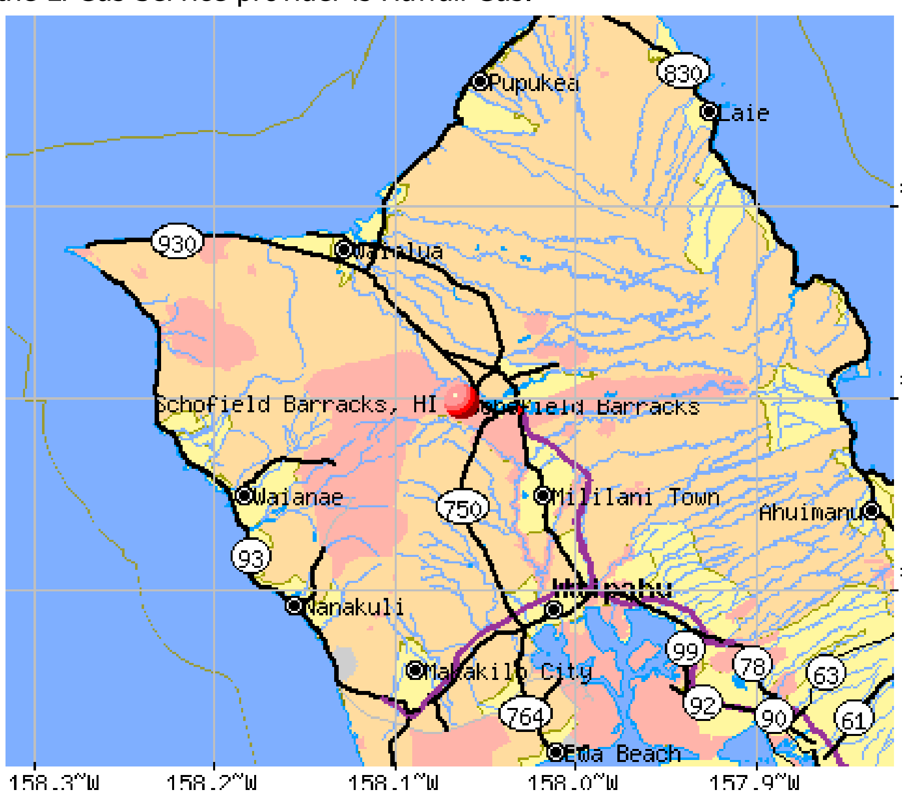
Construction in the 1930's reflected a style called art decor, characterized by its round edges. Also in the 1930's, many of Schofield's fields and streets were named to commemorate outstanding military leaders including Generals Henry Butner and Harry Bishop, Colonels Wright Smith and George Stoneman and Lieutenants William Sills and Guy Benson.

Up until and during the Korean War, Schofield Barracks facilities were under utilized while mainland facilities were overrun with draftees. In 1951, a basic training center was established for replacement troops. The 25th Infantry returned to Hawaii in 1954 to add to the population of Schofield Barracks. The additional troops and families presented a demand for more facilities to include a new commissary, noncommissioned officers' club and the first elementary school.

During the Vietnam Conflict, the barracks were so under utilized that they were remodeled to form semi-private rooms. In the 1970's, upgrades of facilities could be seen all over Schofield Barracks to include commissary, youth and child-care, and restaurant facilities. The post stockade was closed in 1977 and was used as a Correctional Custody Facility until November 1990. H-2, the highway connecting Schofield Barracks to Honolulu, was also completed in 1977.

By the early 1980's, Schofield Barracks was well populated and the largest post operated by the US Army outside the continental United States. Today, Schofield Barracks is a well-maintained and self-contained Army community. The electric service provider is Hawaii Electric and the LPGas Service provider is Hawaii Gas.

The map pictured at right shows the location of Schofield Barracks relative to other geographic areas and points of interest on the island of Oahu, HI.



8.0 Fuel Cell Site Information

The photo at right shows the front elevation of the Schofield Barracks fire station. This site became the consensus favorite after LOGAN and Schofield representatives toured the base. The fire chief expressed great enthusiasm in hosting the project, and the site, itself, provides a good opportunity to install and display the fuel cell to good effect.
The rear elevation of the fire station can bee seen in the photo below. The fuel cell will be placed to the left of the rear door in the space currently occupied by the equipment rack seen below. Fuel cell electric interface with base utility power will be conveniently located in the service panel seen to the right of the rear door pictured below.

Since natural gas is not available in Hawaii, LOGAN has selected an LPGas fuel cell for this project. A 250-gallon LPGas fuel tank will be placed next to the left rear corner of the building to store fuel for the fuel cell. While operating at a power set point of 2.5kW, the Plug Power GenSys5P fuel cell will consume .53 gallons of LPGas per hour. This equates to 20% electrical efficiency, which is low by conventional power generation standards. However, this is a first generation LPGas fuel cell, and the more important issue will be to determine that the product functions in accordance with its design specifications and achieves 90% availability during the test period. When thermal recovery is added to the efficiency equation, then overall efficiency could exceed 55% under ideal circumstances.
It is anticipated that no construction permits will be required at this site.

9.0 Electrical System

The Plug Power GenSys5P PEM fuel cell power plant provides both gird parallel and grid independent operating configurations. This dual capability is an important milestone in the development of the GenSys5 product, and for the PEM Program itself, as it is a significant developmental step on the pathway to product commercialization.

The unit has a power output of 110/120 VAC at 60 Hz, and when necessary the voltage can be adjusted to 208vac or 220vac depending upon actual site conditions. The photo at right shows the electrical service panel in at the rear entrance to the fire station. This is the point of service entry to the facility. Note the absence of a wattmeter indicating that electric service to the facility is not independently metered. However, LOGAN will install a wattmeter at the fuel cell pad to monitor the fuel cell service on both the grid parallel and grid independent circuits.

The fuel cell grid parallel conductor will connect to this panel at a spare 60-amp circuit breaker and provide up to 45 amps electrical service to facility loads. A new fuel cell emergency panel will be installed adjacent to this panel in order to provide up to 35 amps of stand-by power to loads that will be determined by the fire chief during installation. In the event of a utility grid failure during the test period, the fuel cell should carry the dedicated loads until the utility restores power service to the base.

10.0 Thermal Recovery System

While operating at a power set point of 2.5kW, the GenSys5P circulates 8,000Btu/H of 140 degree F. hot water through a customer heat exchanger. If the is no demand for heat, the unit rejects process heat through an air-cooled radiator. In order to capture this thermal energy and provide it to the fire station, LOGAN intends to employ a Heliodyne heat exchanger to transfer the heat to the existing hot water heater, pictured in the photo at right.

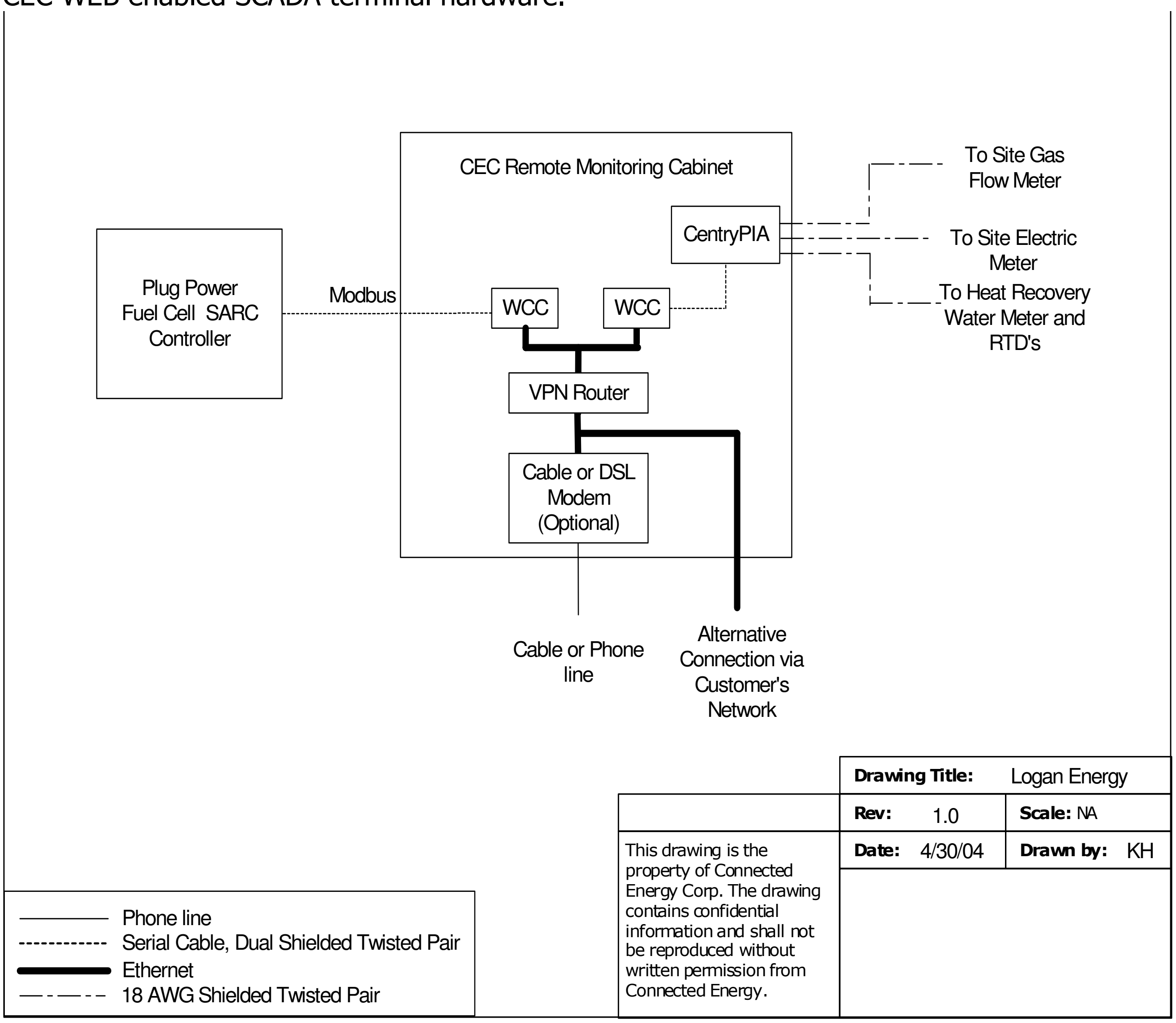
The Heliodyne, shown in a similar application in the photo below, is a "U" shaped coil within a

coil design that provides double wall protection between the heat source and the heat sink. It was designed primarily for the solar heating industry, but has proved to be very adaptable to the fuel cell industry as well. The Heliodyne will mount either directly to the storage tank or on an adjacent wall. It has its own pump that circulates the residential tank in a counter flow against incoming hot water provided by the fuel cell's heat exchanger.   While this method of waste heat recovery typically has a low load factor, the demonstration provides an opportunity to evaluate the effectiveness of the heat transfer system and refine installation methods.

11.0 Data Acquisition System

LOGAN will install a Connected Energy Corporation web based SCADA system that provides real time monitoring of the power plant. The schematic drawing seen below describes the architecture of the Terminal Unit hardware that will support the project. The system provides a comprehensive data acquisition solution and also incorporates remote control, alarming, notification, and reporting functions. The system will capture and display a number of fuel cell operating parameters on functional screens including kWh, cell stack voltage, and water management, as well as external instrumentation inputs including Btu transfer, fuel flow, and thermal loop temperatures. Connected Energy's Operations Control Center in Rochester, New York, collects, stores, displays, alarms, archives site data, and maintains connectivity by means of a Virtual Private Network link to the fuel cell. LOGAN will contract with a local Internet Service Provider to provide high-speed Internet service.

CEC WEB enabled SCADA terminal hardware.



12.0 Economic Analysis

US Army Scofield Barracks, Honolulu, HI					
1) Water (per 1,000 gallons)		$ 0.85			
2) Utility (per KWH)		$ 0.130			
3) LPGas (per gallon)		$ 1.00			
First Cost				**Estimated**	**Actual**
Plug Power 5 kW SU-1				$ 75,000	
Shipping				$ 4,800	
Installation electrical				$ 4,875	
Installation mechanical, LPGas & thermal				$ 13,205	
Web Package				$ 5,200	
Site Prep, labor materials				$ 375	
Training				$ 2,000	
Technical Supervision/Start-up				$ 3,000	
Total				**$ 108,455**	
Assume Five Year Simple Payback				$ 21,691	$ -
Forcast Operating Expenses	Vol/hr	$/Hr		$/ Yr	
LPGas gallons	0.5300	$ 0.53		$ 4,178.52	
Water Gallons per Year	14,016			$ 11.91	
Total Annual Operating Cost					$ 4,190.43
Economic Summary					
Forcast Annual kWH		19710			
Annual Cost of Operating Power Plant		$ 0.213	kWH		
Credit Annual Thermal Recovery Rate		($0.0297)	kWH		
Project Net Operating Cost		$ 0.183	kWH		
Displaced Utility cost		$ 0.130	kWH		
Energy Savings (Cost)		($0.053)	kWH		
Annual Energy Savings (Cost)		($1,042.72)			

13.0 Kickoff Meeting Information

The project kick-off meeting will occur on Monday October 25, 2004 at Schofield Barracks. At that time the purpose scope and of the project will be thoroughly discussed with all of the base stakeholders. If any issues remain unresolved following the meeting, they will be resolved prior to commencing the project. The project Status/Timeline attached to the appendix below is an estimate only, and will be updated after the kick-off meeting if any unresolved issues arise from the meeting.

14.0 Status/Timeline

Please see Appendix 2.

Appendix

1. Sample form used to qualify the fuel cell for initial start and the project acceptance test.

Installation/Acceptance Test Report

Site CA

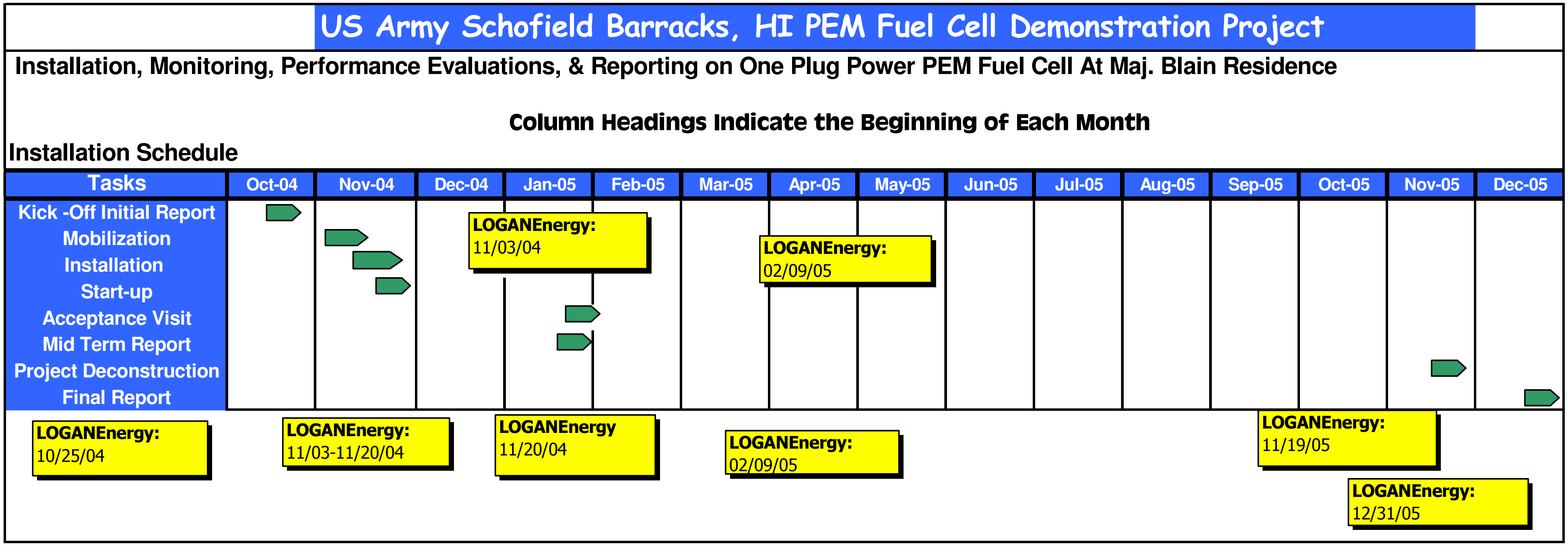
Installation Check List

TASK	Initials	DATE	TIME (hrs)
Batteries Installed	GC		
Stack Installed	GC		
Stack Coolant Installed	GC		
Air Purged from Stack Coolant	GC		
Radiator Coolant Installed	GC		
Air Purged from Radiator Coolant	GC		
J3 Cable Installed	GC		
J3 Cable Wiring Tested	GC		
Inverter Power Cable Installed	GC		
Inverter Power Polarity Correct	GC		
RS 232 /Modem Cable Installed	GC		
DI Solenoid Cable Installed with Diode	GC		
Natural Gas Pipe Installed	GC		
DI Water / Heat Trace Installed	GC		
Drain Tubing Installed	GC		

Commissioning Check List and Acceptance Test

TASK	Initials	DATE	TIME (hrs)
Controls Powered Up and Communication OK	GC		
SARC Name Correct	GC		
Start-Up Initiated	GC		
Coolant Leak Checked	GC		
Flammable Gas Leak Checked	GC		
Data Logging to Central Computer	GC		
System Run for 8 Hours with No Failures	GC		

Appendix 2


US Army Schofield Barracks, HI PEM Fuel Cell Demonstration Project
Installation, Monitoring, Performance Evaluations, & Reporting on One Plug Power PEM Fuel Cell At Maj. Blain Residence
Column Headings Indicate the Beginning of Each Month
Installation Schedule
Tasks
Oct-04
Nov-04
Dec-04
Jan-05
Feb-05
Mar-05
Apr-05
May-05
Jun-05
Jul-05
Aug-05
Sep-05
Oct-05
Nov-05
Dec-05
Kick -Off Initial Report
Mobilization
Installation
Start-up
Acceptance Visit
Mid Term Report
Project Deconstruction
Final Report
LOGANEnergy: 10/25/04
LOGANEnergy: 11/03-11/20/04
LOGANEnergy: 11/03/04
LOGANEnergy 11/20/04
LOGANEnergy: 02/09/05
LOGANEnergy: 02/09/05
LOGANEnergy: 11/19/05
LOGANEnergy: 12/31/05